

CLAIMS

I claim:

- 1 1. A method for causing hypothermia, said method comprising:
2 providing a circulating fluid apparatus having a chiller and a flexible catheter, said
3 catheter having an inner lumen and a hollow flexible heat transfer element
4 adjacent its distal tip;
5 inserting said catheter through the vascular system of a patient to place said heat
6 transfer element in a portion of the vasculature;
7 supplying chilled fluid to said inner lumen of said catheter;
8 cooling the interior of said heat transfer element with said chilled fluid;
9 cooling blood flowing in said portion of the vasculature with said heat transfer
10 element; and
11 returning said fluid to said chiller.

1 2. A method for selective organ hypothermia, said method comprising:
2 providing a circulating fluid apparatus having a chiller and a flexible coaxial
3 catheter, said catheter having an insulated inner lumen and a hollow
4 flexible heat transfer element adjacent its distal tip;
5 inserting said catheter through the vascular system of a patient to place said heat
6 transfer element in a feeding artery of a selected organ;
7 supplying chilled perfluorocarbon fluid to said insulated inner lumen of said
8 coaxial catheter;
9 cooling the interior of said heat transfer element with said chilled perfluorocarbon
10 fluid;
11 cooling blood flowing in said feeding artery with said heat transfer element, to
12 enable said cooled blood to flow distally into said selected organ and cool
13 said organ; and
14 returning said perfluorocarbon fluid to said chiller.

1 3. A method for selective organ hypothermia, said method comprising:
2 providing a coaxial catheter, said catheter having an insulated inner lumen and a
3 metallic heat transfer element;
4 introducing said coaxial catheter into the vascular system of a patient to place said
5 metallic heat transfer element in a feeding artery of an organ of the patient;
6 cooling said metallic heat transfer element by circulating a refrigerant through
7 said insulated inner lumen of said coaxial catheter;
8 cooling blood in said feeding artery by contact with said cooled metallic heat
9 transfer element; and
10 cooling said organ by flow of said cooled blood through said feeding artery.

1 4. A method for selective brain hypothermia, comprising:
2 providing a flexible coaxial catheter, said flexible catheter having an insulated
3 inner lumen and a flexible metallic heat transfer element;
4 introducing said flexible coaxial catheter into the vascular system of a patient to
5 place said flexible metallic heat transfer element in the carotid artery of the
6 patient;
7 cooling said flexible metallic heat transfer element by circulating a refrigerant
8 through said insulated inner lumen of said flexible coaxial catheter;
9 cooling blood in said carotid artery by contact with said cooled flexible metallic
10 heat transfer element; and
11 cooling the brain of the patient by flow of said cooled blood through said carotid
12 artery.

1 5. A method for selective hypothermia of the heart of a patient, comprising:
2 providing a flexible coaxial catheter, said flexible coaxial catheter having an
3 insulated inner lumen and a flexible metallic heat transfer element;
4 introducing said flexible coaxial catheter into the vascular system of a patient to
5 place said flexible metallic heat transfer element in a feeding artery of the
6 heart of the patient;
7 cooling said flexible metallic heat transfer element by circulating a refrigerant
8 through said insulated inner lumen of said flexible coaxial catheter;
9 cooling blood in said feeding artery by contact with said cooled flexible metallic
10 heat transfer element; and
11 cooling the heart of the patient by flow of said cooled blood through said feeding
12 artery..

- 568 / 1
2. An apparatus for selective organ hypothermia, said apparatus comprising:
- 2 a circulating unit adapted for chilling and circulating a fluid;
 - 3 a flexible elongated catheter;
 - 4 a flexible tubular outer catheter body on said catheter;
 - 5 a flexible fluid supply tube within said outer catheter body, a proximal end of a
 - 6 central lumen of said fluid supply tube being connected in fluid flow
 - 7 communication with an outlet of said circulating unit;
 - 8 a fluid return lumen within said outer catheter body, a proximal end of said fluid
 - 9 return lumen being connected in fluid flow communication with an inlet
 - 10 of said circulating unit; and
 - 11 a flexible heat transfer element mounted to a distal end of said outer catheter
 - 12 body, said heat transfer element having a partially helical shape to
 - 13 increase the surface area available for heat transfer.

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1 A cooling apparatus, comprising:
2 a circulating unit adapted for chilling and circulating a fluid;
3 a flexible elongated catheter;
4 a flexible tubular outer catheter body on said catheter;
5 a flexible, insulated, supply tube within said outer catheter body, a proximal end
6 of a central lumen of said supply tube being connected in fluid flow
7 communication with an outlet of said circulating unit;
8 a return lumen within said outer catheter body, said return lumen substantially
9 surrounding said fluid supply tube, a proximal end of said return lumen
10 being connected in fluid flow communication with an inlet of said
11 circulating unit; and
12 a flexible heat transfer element mounted to a distal end of said outer catheter
13 body, said heat transfer element having a partially helical shape to increase
14 the surface area available for heat transfer;
15 wherein said fluid supply tube comprises a wall having insulating properties to
16 reduce heat transfer from said return lumen to said central lumen of said
17 fluid supply tube.

1 8. An apparatus for causing hypothermia, said apparatus comprising:
2 a circulating unit adapted for chilling and circulating a fluid;
3 a flexible elongated catheter;
4 a flexible tubular outer catheter body on said catheter;
5 a flexible fluid supply tube within said outer catheter body, a proximal end of a
6 central lumen of said fluid supply tube being connected in fluid flow
7 communication with an outlet of said circulating unit;
8 a fluid return lumen within said outer catheter body, a proximal end of said fluid
9 return lumen being connected in fluid flow communication with an inlet
10 of said circulating unit; and
11 a flexible heat transfer element mounted to a distal end of said outer catheter
12 body, said heat transfer element having an at least partially ballooned
13 shape to increase the surface area available for heat transfer.

1 9. An apparatus for causing hypothermia, said apparatus comprising:
2 a circulating unit adapted for chilling and circulating a fluid;
3 a flexible elongated catheter;
4 a flexible tubular outer catheter body on said catheter;
5 a flexible fluid supply tube within said outer catheter body, a proximal end of a
6 central lumen of said fluid supply tube being connected in fluid flow
7 communication with an outlet of said circulating unit;
8 a fluid return lumen within said outer catheter body, a proximal end of said fluid
9 return lumen being connected in fluid flow communication with an inlet
10 of said circulating unit; and
11 a flexible heat transfer element mounted to a distal end of said outer catheter
12 body, said heat transfer element having an at least partially oval shape to
13 increase the surface area available for heat transfer.

Add 62